

## ARSENAL 250 AR, IMAZAPYR - TOTAL VEGETATION HERBICIDE

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*Summary.* Imazapyr is a new broad spectrum herbicide for total vegetation control. It is a member of a new chemical group - the imidazolinones. In plants, imazapyr acts by inhibiting the AHAS enzyme and hence cell division. Imazapyr has a low toxicity to mammals and is rapidly excreted by rats. After application, imazapyr is rapidly absorbed through the foliage and roots, and therefore provides post-emergence and pre-emergence weed control. In Australia residual control of weeds on sites treated with 1000 to 1500 g/ha of imazapyr has typically been three to nine months. Symptoms in treated plants develop sooner when plants are actively growing.

## INTRODUCTION

Imazapyr is a member of the imidazolinones, a new class of herbicides discovered by scientists at American Cyanamid Company's Agricultural Research Centre, Princeton, N.J., U.S.A. (2). In Australia it will be marketed by Shell Chemical (Australia) Proprietary Limited as Arsenal 250 AR. This paper outlines the characteristics of this product and its uses.

## CHARACTERISTICS

Mode of action. Imazapyr is absorbed through the roots and foliage and translocated in both the xylem and phloem to the meristematic regions where it accumulates. At these sites imazapyr inhibits the acetohydroxy acid synthase enzyme (AHAS), which is important in the synthesis of three branched-chain aliphatic amino acids - valine, leucine and isoleucine (4). These compounds are vital for protein synthesis, and in their absence cell division virtually ceases.

Toxicology. Since the biosynthesis of the above amino acids and the AHAS enzyme do not occur in animals the user safety of imazapyr is excellent. The oral and dermal LD<sub>50</sub>'s for rats are greater than 2000 mg/kg. Accidental exposure is unlikely to cause any acute or long term reaction.

Absorption. Foliage absorption of imazapyr is extremely rapid and rain falling soon after application is unlikely to affect weed control. In Indonesia rain falling thirty minutes after treatment did not affect control of blady grass, *Imperata cylindrica* (M. Jackson, pers. comm., 1987).

For post-emergence applications, foliage absorption is far greater than root absorption. Differences occur between species but the proportions range from, 60 to 70% via the foliage, and 30 to 40% via the roots (T. Peoples, pers. comm., 1986).

Soil degradation. The major routes of degradation of imazapyr in the field are microbial and chemical degradation and photolysis (3). Consequently degradation under field conditions is dependent upon prevailing conditions. Three to nine months of residual weed control has been observed in Australian trials.

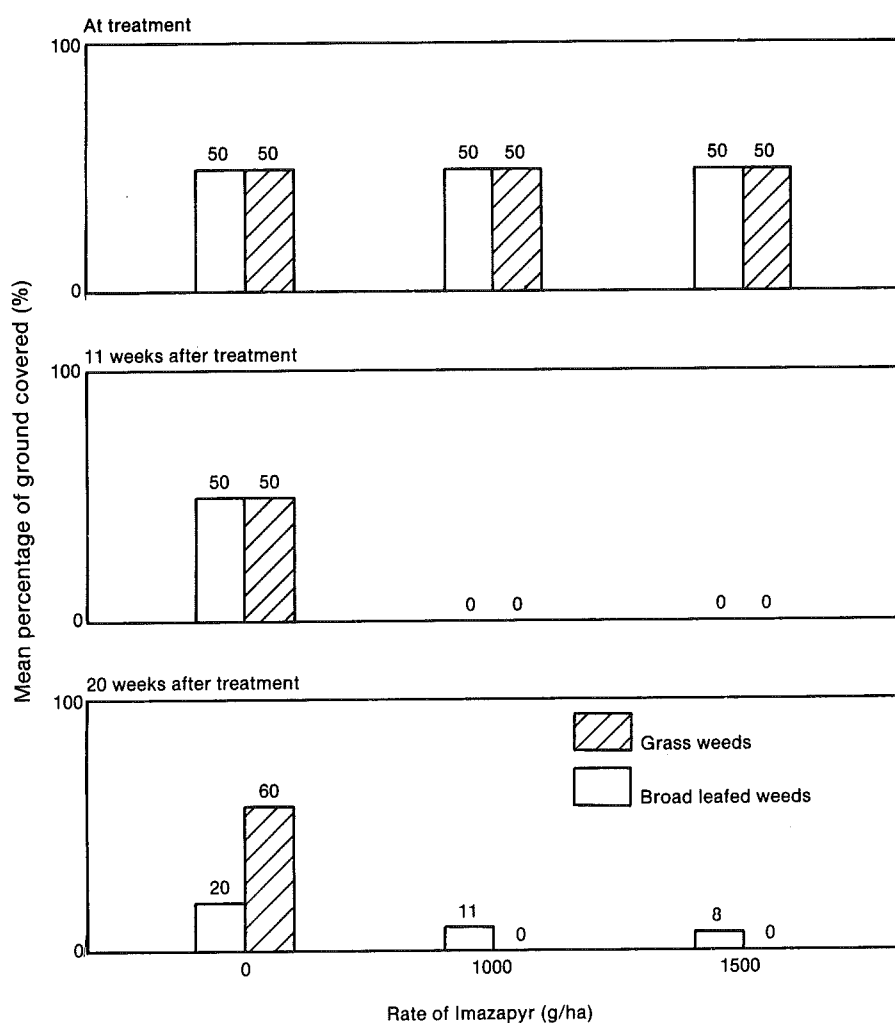


Figure 1. Reinvasion of railway easement after treatment with imazapyr. (Sprayed July 1986; weeds present *Paspalum dilatatum*, *Lolium* sp., *Avena* sp., *Echium plantagineum*, *Hordeum* sp., *Bromus* sp. and *Vulpis* sp.)

#### SPECTRUM OF WEEDS CONTROLLED

Imazapyr is a broad spectrum herbicide active against grasses, broad leaved weeds, and sedges. Imazapyr has been evaluated against a wide range of annual and perennial weeds in Australia.

Susceptible Weeds

|  |   |
|--|---|
| Annual ryegrass, <i>Lolium rigidum</i>             | Barnyard grass, <i>Echinochloa crus-galli</i> |
| Blackbush, <i>Salsola kali</i>                     | Blady grass, <i>Imperata cylindrica</i>       |
| Bokhara clover, <i>Melilotus alba</i>              | Bracken, <i>Pteridium esculentum</i>          |
| Capeweed, <i>Arctotheca calendula</i>              | Couch, <i>Cynodon dactylon</i>                |
| Deadnettle, <i>Lamium amplexicaule</i>             | Dock, <i>Rumex</i> sp.                        |
| Fleabane, <i>Conyza canadensis</i>                 | Hexham scent, <i>Melilotus indica</i>         |
| Johnson grass, <i>Sorghum halepense</i>            | Liverseed grass, <i>Urochloa panicoides</i>   |
| London Rocket, <i>Sisymbrium irio</i>              | Mayne's pest, <i>Verbena tenuisecta</i>       |
| Medics, <i>Medicago</i> spp.                       | Mintweed, <i>Salvia reflexa</i>               |
| Blackberry nightshade, <i>Solanum rigrum</i>       | Panic, <i>Panicum</i> sp.                     |
| Paspalum, <i>Paspalum dilatatum</i>                | Paterson's curse, <i>Echium plantagineum</i>  |
| Plains grass, <i>Stipa aristiglumis</i>            | Prairie grass, <i>Bromus catharticus</i>      |
| Scented top, <i>Capillipedium</i> sp.              | Sedge, <i>Cyperus</i> sp.                     |
| Sowthistle, <i>Sonchus oleraceus</i>               | Stinging nettle, <i>Urtica incisa</i>         |
| Summer grass, <i>Digitaria</i> sp.                 | Thornapple, <i>Datura</i> sp.                 |
| Turnip weed, <i>Rapistrum rugosum</i>              | Vasey grass, <i>Paspalum urvillei</i>         |
| Wild Oats, <i>Avena</i> sp.                        | Wild turnip, <i>Brassica tournefortii</i>     |
| Purple top, <i>Verbena bonariensis</i>             | Wireweed, <i>Polygonum aviculare</i>          |
| Prickly lettuce, <i>Lactuca serriola</i>           | Variegated thistle, <i>Silybum marianum</i>   |
| Slender celery, <i>Apium leptophyllum</i>          |   |
| Prickly, lettuce, <i>Lactuca serriola</i>          |   |
| Feathertop Rhodes grass, <i>Chloris virgata</i>    |   |
| Slender celery, <i>Apium leptophyllum</i>          |   |
| Queensland blue grass, <i>Dichanthium sericeum</i> |   |
| St Barnaby's thistle, <i>Centurea solstitialis</i> |   |
| Warrego summer grass, <i>Paspalidum jubiflorum</i> |   |

Legumes tend to be less sensitive to imazapyr than other families (1). In Australian field trials thistles, *Sonchus* sp., docks, *Rumex* sp. and Paterson's curse, *Echium plantagineum*, have been among the first reinvaders after treatment.

In Fig. 1 the changes in weed cover on a section of railway line in southern N.S.W. sprayed at two doses of imazapyr are presented. All weeds in the section of track treated with imazapyr were controlled for about three months, after which thistles, docks, and Paterson's curse began to grow close to the edge of the ballast.

## SAFETY TO NON TARGET SPECIES

Root absorption. Imazapyr applied onto foliage, through stem injection and onto cut stumps is being evaluated as a brush and timber herbicide. Imazapyr has the potential to damage desirable trees if a sufficient amount is absorbed by their roots. Trials are currently being conducted in Australia to determine how close imazapyr may be applied to desirable species without detrimental effect. Preliminary results of these tree safety trials are encouraging.

Soil movement. Once applied imazapyr is tightly bound to soil particles (2). Although imazapyr is very soluble, it has not been observed to be transported in moving water either laterally or vertically unless the soil particles move. This characteristic may account for the observed safety of this material.

## PLANT RESPONSES

**Symptoms.** Plants treated with imazapyr become chlorotic, necrotic and lose leaf lustre. Plants stop growing immediately and symptoms normally develop after two to four weeks. The rate of development may vary according to environmental conditions, with symptoms developing earlier when treated plants are growing rapidly.

**Trial Results.** Imazapyr was applied to a sward of Johnson grass, *Sorghum halepense*, in which both vegetative and flowering stages were present (Fig. 2). Plants in the vegetative stage at application developed symptoms more rapidly than those in the flowering stage. When the trial site was inspected thirteen months after treatment, both stages appeared to have been equally affected.

In this experiment glyphosate (2160 g a.i./ha) and a mixture of glyphosate, diuron and bromacil (2160+10000+10000 g a.i./ha) were included for comparison. Imazapyr applied at 1000 and 1500 g/ha acted more slowly than either of the comparison treatments, particularly against the flowering form of Johnson grass. At three months after treatment, control of the vegetative form with imazapyr appeared superior to glyphosate applied alone, and slightly inferior to the three way mixture.

For adequate control of Johnson grass 1500 g/ha of imazapyr appeared to be required. This dose provided long term control, equivalent to the three way mixture.

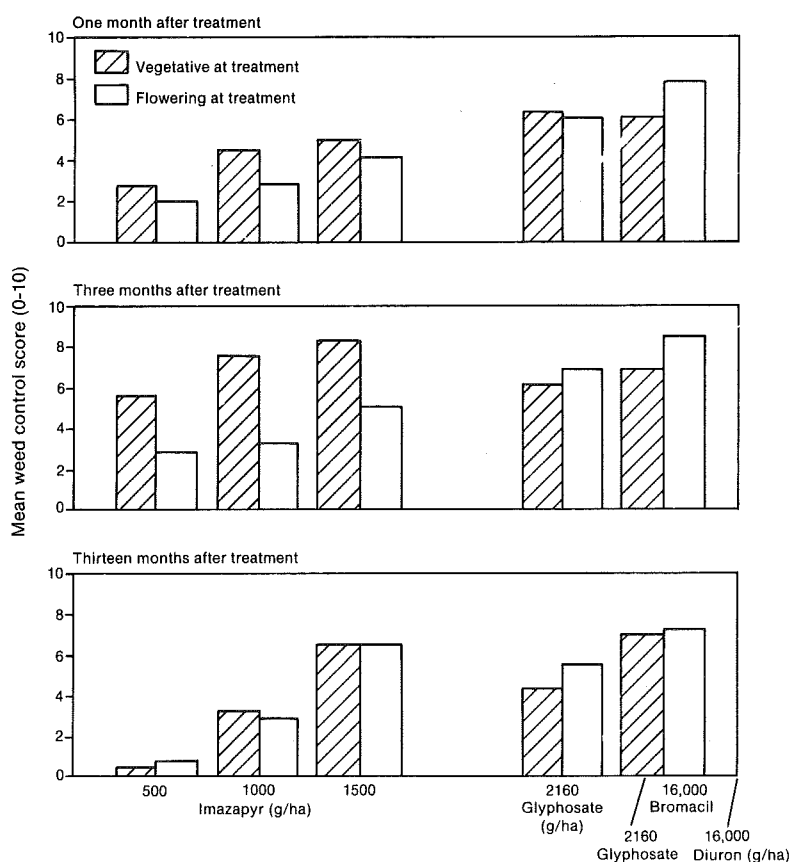


Figure 2. The responses of vegetative and reproductive forms of Johnson grass to treatment with imazapyr (Sprayed Dec. 1984)

## CONCLUSION

Use of imazapyr. Imazapyr combines effective knockdown, and residual action against a wide range of weeds, (including a number of hard to control perennial weeds e.g. blady grass, Johnson grass, and paspalum with low user, and environmental hazard. This unique material will have application in a variety of total vegetation control situations, and if further trials support the previous findings on tree safety, imazapyr could provide a safe and effective alternative for use in environmentally sensitive areas.

Imazapyr formulated as Arsenal 260 AR will be registered for the control of various annual and perennial weeds in non-crop situations. The rates will be 1000 to 1500 g/ha, depending upon the species present.

## REFERENCES

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